Math 1210-3
Friday Jan 11 P.3

Quiz is during last 15 minutes of class.

- Ms. Hsiang-Ping Huang, who is the webworks administrator, will give a brief into. to using webworks
- Regarding webworks, the following sets are open:
  - Demo : very brief introduction
  - Set 0 : more in depth intro, reviewing common algebra computations, and practice entering answers correctly

  these sets do not count towards your grade, but I strongly recommend you do enough of them to know you could do all of them.
  - Set 1 : P.1-P.5 This set does count. The set closes on Monday Jan. 21, at 11:59 p.m.

- Starting Monday I expect you to download the class notes from our homepage, and to bring them to class. I will always try to have the notes posted by 3 p.m. of the immediately preceding weekday. So, our notes for Monday should be posted by 3 p.m today

Exercise 1 Use the limit definition of derivative to work out the slope function $f'(x)$, for $f(x)=x^3$

$f(x)$	$f'(x)$
1	0
x	1
x^2	$2x$
x^3	

Exercise 2 Using Theorem B from Wed notes $\begin{pmatrix} (f+g)' = f'+g' \\ (cf)' = cf' \end{pmatrix}$, what is

$$\left(10x^3 - 12x^2 + 5x - \pi^3\right)'$$

In order to take the derivative of any polynomial the key step is to figure out the derivative of

$f(x) = x^k$ $\qquad$ k a whole number

$$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^k - x^k}{h}$$

pattern:

Pascal's Δ records the coefficients... fill this in.

$$\begin{array}{ccccccc} & & & 1 & & & \\ & & 1 & & 1 & & \\ & 1 & & 2 & & 1 & \\ 1 & & & & & & \end{array}$$

$$\begin{aligned}
(x+h)^0 &= 1 \\
(x+h)^1 &= 1x + 1h \\
(x+h)^2 &= 1x^2 + 2xh + 1h^2 \\
(x+h)^3 &= (x+h)(1x^2 + 2xh + 1h^2) = \boxed{1}x^3 + \square x^2h + \square xh^2 + \boxed{1}h^3 \\
(x+h)^4 &= \square x^4 + \square x^3h + \square x^2h^2 + \square xh^3 + \square h^4 \\
&\vdots
\end{aligned}$$

notice the numbers in successive rows are obtained by adding the two nearest numbers ~~at~~ in the row above. In fact the numbers are called the <u>binomial coefficients</u>, and there is a formula for them; the coefficient for $x^{k-j}h^j$ is $\binom{k}{j} = \frac{k!}{j!(k-j)!}$.

Deduce

$$(x+h)^k = x^k + khx^{k-1} + (\text{terms with at least a factor of } h^2)$$

So

$$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^k - x^k}{h} = \frac{[\cancel{x^k} + khx^{k-1} + (\text{extra terms})] - \cancel{x^k}}{h}$$

$$\% = kx^{k-1} + (\text{terms with at least a factor of } h)$$

So

$$f'(x) = \lim_{h \to 0} (\%) = kx^{k-1}$$

$$\boxed{\underline{\text{Theorem A}} \quad (x^k)' = kx^{k-1}}$$